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News selection and framing: the media as a stakeholder in human-carnivore coexistence

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Title

News selection and framing: the media as a stakeholder in human-carnivore coexistence

Running title

Human-carnivore coexistence and the media

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TITLE

News selection and framing: the media as a stakeholder in human-carnivore coexistence

ABSTRACT

The media widely covers large carnivores and their impacts on human livelihood and plays an important role in their conservation. Yet, we know little about how species identity affects news selection, framing, accuracy and information flow. We investigated the online coverage of two cases of attacks or alleged attacks on humans alternately attributed to wolves and dogs in Greece and Germany. The period during which wolves were considered the primary suspects for the attacks was covered by up to two times more articles than when dogs were suspected. Wolves were presented as more likely suspects for the attacks than dogs, and wolf articles contained more inaccuracies measured as title-text mismatches. Press agencies played a significant role in the selection and dissemination of wolf news. We suggest that conservation scientists, journalists and policy makers work together to ensure an accurate representation in the media of human-carnivore coexistence and its challenges.

INTRODUCTION

Human-carnivore coexistence is an intensely debated topic with a corresponding broad resonance in the media (Chapron et al. 2014; Chapron & López-Bao 2016). The mass media can be defined as a key stakeholder in conservation (Reed 2008; Durham et al. 2014), because of the impact of media agenda on public agenda, i.e. its agenda-setting role (McCombs 2005). Hence, news organizations can play a positive role in conservation, e.g. by raising species awareness (Fernández-Bellon & Kane 2020). They can also affect species management, e.g. when voicing public protests against shark hazard mitigation measures (McCagh et al. 2015). Four topics are especially important for conservation scientists to better understand the role of the media for human-carnivore coexistence: how news are selected, how they are framed, what is the level of news accuracy (i.e. level of title-text mismatch), and how the information flows among news organizations.

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3 First, one needs to understand what makes news about large carnivores worth
4 publishing. Journalists tend to select news stories according to ten major criteria of
5 newsworthiness: power elite, celebrity, entertainment, surprise, bad news, good news,
6 magnitude, relevance, follow-up and newspaper agenda (see Harcup & O'Neill 2001 for a full
7 description). It follows that stories involving carnivores in European human-dominated
8 landscapes often satisfy the criteria of entertainment (charismatic animal), surprise
9 (depredation events, drama), bad news (livestock loss, injury or fatality), good news
10 (conservation success) and relevance (currently ongoing wolf range expansion in many regions).
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18 Second, news framing, i.e. the way an information is interpreted by the journalist and
19 presented to the public (Brüggemann 2014), can have an important impact on public opinion
20 (Scheufele 1999). Since only few people directly interact with large carnivores (i.e. farmers,
21 hunters), public opinion of human-carnivore coexistence is often shaped by media coverage
22 and news frames (Bombieri et al. 2018). The media portrayal of large carnivores tends to focus
23 more on negative aspects of their presence (Bombieri et al. 2018), which can artificially increase
24 public's risk perception and have long-lasting consequences on public support for carnivore
25 conservation (Gore et al. 2005). Such negative framing is critical because negative perceptions
26 have greater impact on attitudes than positive perceptions (Kansky & Knight 2014). Eventually,
27 the media-induced risk amplification can affect stakeholders' behavior and support for
28 management and policy, and can therefore affect conservation efforts (e.g. mitigation
29 strategies, communication campaigns) (Gore & Knuth 2010).
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40 Third, reporting accuracy is a fundamental, if not the primary principle of journalism
41 (e.g. Editor's code of practice 2019; Tuchman 1972). Inaccuracies consist of misleading or
42 distorted information, including headlines not supported by the main text. In the context of
43 carnivore conservation, inaccuracies are problematic as they mislead the audience on the
44 reality of human-carnivore coexistence, and affect news organizations' credibility on the topic
45 (Maier 2005).
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51 Fourth, it is essential to understand how the information flows between news
52 organizations (de Lange et al. 2019), to identify key actors of news selection and dissemination
53 at a time where news quickly spread across borders. It can reveal important telecoupling
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3 processes (i.e. social and environmental interactions over distances) (Liu et al. 2013), whereby
4 news quickly affect distant audiences' perceptions of large carnivores (Macdonald et al. 2016)
5 and can trigger management decisions (e.g. calls for population control of predators).
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9 Perception of risk is a fundamental component of human-wildlife coexistence, as high
10 levels of perceived risk can lead to disproportionate impacts on wildlife (Dickman 2010). In fact,
11 the media plays a decisive role in shaping risk perception, and is thus one of the many factors
12 potentially contributing to conflict escalation or de-escalation (Cusack et al. 2021). Despite their
13 potential importance for conservation, news selection, accuracy, framing and information flow
14 have received little attention and certainly have not been studied in combination. Furthermore,
15 news selection, framing and accuracy have not been investigated in relation to species-specific
16 differences, although this is critical to identify species that are of particular concern with regard
17 to news coverage.
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25 Here, we investigated news selection, framing, accuracy and information flow in relation
26 to two cases of alleged wolf (*Canis lupus*) and dog (*Canis lupus familiaris*) attacks on humans.
27 The two cases mirror each other in that (i) news coverage was split in two phases as the
28 respective attacks have been alternately attributed to wolves and dogs, (ii) they recently
29 occurred in Europe (Greece - 2017, Germany - 2018) in the absence of witnesses except the
30 victim; and (iii) they rapidly triggered an important peak in local and national media coverage.
31 These two cases provide a unique, quasi-experimental design to investigate differences in (i)
32 news selection (number of articles), (ii) framing (article content), (iii) accuracy (title-text
33 mismatches) and (iv) information flow (publication networks) among news featuring the alleged
34 wolf and dog attacks.
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46 **METHODS**

47 *Case studies descriptions*

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49 The first case refers to the death of a British hiker in Greece on September 21st 2017
50 ("Greek case" hereafter). In the first phase (22-25/9), the media mainly reported it as a dog-
51 related fatality, as the victim – before her death – called her family to say that she was under
52 attack by dogs. In the second phase (26-29/9), the media mainly reported wolves as responsible
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3 for the attack, after the coronary was quoted in an article from The Times (London) saying the
4 victim “may have been attacked by wolves” and potentially “rabid wolves or jackals” (de
5 Bruxelles & Carassava 2017). Later investigations led to the charge of a local shepherd for
6 negligent homicide, for not properly controlling his livestock-guarding dogs (court decision
7 pending).
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12 The second case refers to an incident in Germany on November 27th 2018, when the
13 local police published a press release stating that “a worker from the Bülstedt municipality was
14 bitten by a wolf at the cemetery in Steinfeld” (“German case” hereafter) (Kreiszeitung 2018). In
15 the first phase, the media mainly reported a wolf-related injury (28/11- 3/12). In the second
16 phase (4-9/12), the media mainly reported the results of the environmental DNA investigation,
17 which showed no evidence of wolves being present in the area, and only evidence of dogs, roe
18 deer (*Capreolus capreolus*) and domestic cat (*Felis catus*). See Supporting Information Methods
19 S1 for more details.
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27 We could not find any other modern record of a carnivore attack on somebody that
28 involved a similar reporting where two species were alternatingly blamed for the incident (i.e.
29 providing the same quasi-experimental set-up).
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34 *News selection*

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36 We searched for free-access, online articles pertaining to both case studies. For the
37 Greek case, we searched for articles in the 27 European Union countries and the European
38 countries for which the European Journalism Centre provided a description of the “media
39 landscape” (EJC, <http://ejc.net/> during our research; currently at <https://medialandscapes.org>)
40 (n=33 in total). For each website listed in a country’s “Print Media” and “Digital Media” section
41 of the EJC website, we searched for articles matching the following keywords in the local
42 language: the victim’s name, Greece, wolf, dog, attack, Maroneia, Rodopi, Komotini, British
43 tourist, and checked all online articles for the period spanning over phase 1 and phase 2.
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45 Additionally, we searched for articles using the same key words in local language using Google
46 and Google News. Finally, we checked all online articles quoted by the ones we had already
47 detected, and included them for the analysis. We used the same approach for the German case,
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3 but since the incident was mostly covered by German media, we focused our analysis on
4 German articles. We searched for publications matching the following keywords in German in
5 Google: Steinfeld, wolf, animal bite, attack, cemetery, DNA.
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10 *News framing*

11 We categorized the content of each article title and text in relation to the animal species that
12 were described as being potentially responsible for the attack, namely: dogs, wolves or other
13 animals (jackals – *Canis aureus* – and unknown wild animals). To investigate species framing,
14 each species was categorized as being “responsible”, “probably responsible” or “possibly
15 responsible” for the attack in the main text as well as in the title of each article, adopting a
16 conservative approach for ambiguous content, i.e. using the most cautious category of those
17 occurring in the same title or text (See Supporting Information Methods S2). We adopted the
18 same approach for the German case and we categorized articles’ titles and texts in relation to
19 the two species (dogs and wolves), in six categories: “responsible”, “probably responsible”,
20 “possibly responsible” for the attack, “no proof of wolf attack”, “probably not responsible” and
21 “not responsible” for the attack. Furthermore, we recorded the occurrence of violent terms in
22 the articles’ titles (e.g. containing words like “attack”, “horror”, “bloody”, “mauled to death”,
23 etc.). Finally, to investigate the variability in the individual articles’ content and ensure that the
24 results on accuracy and framing do not solely hinge on the few news outlets that did the
25 original reporting of the two cases, we conducted a corpus data analysis. We investigated text
26 dissimilarity using hierarchical clustering and Natural Language Processing for three languages,
27 namely English, German and Greek languages (Fig. S1 in Supporting Information).
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45 *News accuracy*

46 We investigated the extent to which title and text content matched for each species based on
47 the categorization of title versus main text. We created contingency tables for each species in
48 each publication phase. We calculated accuracy as the proportion of articles where title and
49 text content were matching, i.e. they would appear on the diagonal of the contingency table.
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54 Note that this measure of news accuracy is not equivalent to news truthfulness.
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Information flow

To understand the information flow among news organizations, we conducted a network analysis using the “igraph” package (Csardi & Nepusz 2006) in R (R Core Team 2019). As articles quoted news organizations rather than specific articles, we created directed networks where network nodes represent news organizations, and compared them across the two phases of each case. We investigated the structure of each network based on edge betweenness and network modularity. Modular networks contain clusters of nodes with dense connections to each other within one cluster, but few connections to nodes belonging to other clusters, as opposed to centralized networks where nodes are well connected to each other and a few nodes have higher-than-average number of connections.

RESULTS

We found 273 online articles in 28 countries for the Greek case (Fig. 1), and 287 articles for the German case. News selection (i.e. number of online articles) was 1.8 to 2 times higher in the period during which wolves were considered the primary suspects for the attacks than when dogs were suspected (Greek case: n=97 articles from 77 sources in phase 1; n=176 from 148 sources in phase 2; German case: n=193 from 93 sources in phase 1; n=94 from 62 sources in phase 2).

Framing of dog-related and wolf-related attacks differed (Fig. 2 & Fig. 3). In the Greek phase 1, most articles depicted dogs as being “responsible” (40 %), “probably” (10 %) or “possibly responsible” (15%) for the attack. In phase 2, after the coroner’s interview, dogs were hardly mentioned in the titles (7%), and wolves were framed as being either “responsible” (46 %), “probably” (7 %) or “possibly” responsible (6 %) for the attacks in the titles (Fig. 2; see Supporting Information Figure S2 for other species).

In the German phase 1, wolves were mostly framed as being “possibly” responsible for the attack (79% of titles), while dogs were hardly mentioned in titles (18 %) (Fig. 3). In phase 2, after DNA results were known, dogs were framed as “possibly” responsible for the attack only in news’ texts (60 %, only 3% in titles), while wolves were still mentioned both in texts and titles and mostly framed as “possibly” responsible for the attack (44 % of publications’ texts) (Fig. 3).

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3 Additionally, the proportion of titles containing violent terms was higher in the Greek phase 2
4 than in phase 1 (73% vs. 54%), and higher in the German phase 1 than in phase 2 (69% vs 44%)
5 (Supporting Information Fig. S3). The additional corpus data analysis in three languages
6 demonstrated the variation in article content in each case study, with up to 4 identified clusters
7 of publications (with variations in words used and text length within clusters), corresponding to
8 as many original stories in each phase of each case study (Fig S4-S10 in Supporting Information).
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14 In both cases, accuracy was highest in phase 1 (66% accuracy in articles featuring dogs in
15 the Greek case, and 76% in those featuring wolves in the German case). In phase 2 of the Greek
16 case, accuracy was higher in articles featuring dogs than wolves (67% vs 31%, respectively). In
17 phase 2 of the German case, accuracy was higher in articles featuring dogs than wolves (41% vs
18 24%, respectively). The variation in news accuracy was independent from the original reports
19 on each case study (Fig S11-S12 in Supporting Information).
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25 The information flow differed between phase 1 and phase 2 of the Greek case (Fig. 4). In
26 phase 1 (dog involvement), articles were mostly linked to Greek (ANA-MPA press agency, ERT)
27 and British media (e.g. The Telegraph, The Guardian, The Times, The Mirror). In phase 2 (wolf
28 involvement), publications were more international and mostly related to British organizations
29 or national (e.g. German and Austrian press agencies, Beta News Agency) and international
30 press agencies (Associated Press). Hence, network modularity was lower in phase 1 (0.54) than
31 in phase 2 (0.64) and we found more node clusters in phase 2 (n=14) than in phase 1 (n=6)
32 (Supporting Information, Fig. S13). We detected 11 and 17 isolated nodes in phase 1 and 2,
33 respectively (i.e. nodes with no connections).
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42 The information flow was similar in the networks of both phases of the German case,
43 which were focused around DPA press releases (Fig. 5, Supporting Information Fig. S14). They
44 differed in that the modularity was higher in phase 1 (wolf involvement) (0.41, 4 clusters, 12
45 isolated nodes) than in phase 2 (dog involvement) (0.32, 5 clusters, 11 isolated nodes).
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52 DISCUSSION

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54 Our results show that news organizations selected wolf over dog stories, that they tended to
55 present wolves as more likely suspects for the attacks than dogs, and that accuracy of articles
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3 featuring wolves was lower than those featuring dogs. Our analysis of the information flow in
4 the Greek and German cases revealed the significant role of press agencies in the selection and
5 dissemination of wolf news. It is important to note that despite the presence of re-reporting of
6 original information across news organizations, this alone did not explain the editorial
7 processes that (purposefully or not) led to differential news selection, framing and accuracy
8 between wolf and dog publications.
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16 *Differential news selection, framing and accuracy*

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18 Both cases revealed differences in news selection, framing and accuracy between wolf- and
19 dog-related stories. Both cases confirmed the newsworthiness of wolf stories despite the
20 unlikelihood of such an attack in Europe (Linnell et al. 2021). The media selection of such
21 isolated events as news, and the framing around the attribution of wolf responsibility in the
22 alleged attacks may divert attention from larger issues associated with wolves (e.g.
23 implementation of prevention measures against livestock depredations in Germany) or free-
24 roaming dog management in Greece (Kim 2015). The fact that news organizations relayed the
25 Greek case intensely in some countries (e.g. Germany) illustrates the high local relevance and
26 potential intensity of conflicts over wolf management (Cusack et al. 2021). Besides, as stories
27 with subjective writing style and polarized sentiments are more prone to be shared through
28 social media (Harcup & O'Neill 2017), the more violent terms in the titles of wolf compared to
29 dog stories may be especially problematic and public opinion of wolves may be altered at a
30 large scale (Scheufele 1999). Recent studies have revealed changes in news framing of large
31 carnivores over time (Killion et al. 2018), between local and national scales (Chandelier et al.
32 2018) and across carnivore species (Bombieri et al. 2018), and future studies should look into
33 the actual effects of such framing on people's attitudes towards large carnivores. The
34 perpetuation of negative framings and increased media salience can transfer into increased
35 personal salience (Atwater et al. 1985), contributing to risk amplification in people's opinion
36 and to decreasing support for conservation (Gore & Knuth 2009). Such coverage, which is often
37 loaded with negative sentiments in the context of human-wolf coexistence (Arbieu et al. 2021),
38 may reinforce people's belief that wolves are dangerous to humans. Thus, over the long term,
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3 the media can directly or indirectly affect policy activity (Miller et al. 2018). Finally, lower
4 accuracy in wolf-related news tended to blur the message about wolf responsibility in these
5 alleged attacks. Journalists usually use quotation (Tuchman 1972) and verification (Shapiro et
6 al. 2013) as strategies to ensure accuracy, yet e.g. only 20% of article titles in the Greek phase 2
7 referred to the coronary's opinion.
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14 *Telecoupling processes and key actors of information flow*

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16 Our results suggest important telecoupling processes, whereby the news of an alleged wolf
17 attack in one location spread over most European countries (Fig. 1), triggering political stances
18 and potential management decisions in other locations. Hence, after the incident in Greece, the
19 German Federal Ministry of Agriculture publicly called for lifting the wolf's strictly protected
20 species status (Heine 2017). Furthermore, 33 articles on the German case mentioned the until
21 then "unresolved case" of the alleged "wolf attack" in Greece, perpetuating the representation
22 of wolves as a public threat, although both alleged attacks most probably did not involve
23 wolves (Supporting Information S1). Such telecoupling processes uncover the potential
24 influence of the media in carnivore conservation, which trespasses ecological and socio-political
25 boundaries (Dallimer & Strange 2015).
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34 The analysis of publication networks highlighted the role of national and international
35 press agencies in selecting, framing and sharing the news of alleged wolf attacks. Press agencies
36 are major sources of information for news organizations that can quickly reach local to
37 international audiences (Hamer 2006). In particular, the increasing homogenization and
38 concentration of online news structures (Cottle 2009) facilitates the fast exchange of
39 information at broad scales (see e.g. German media concentration: [https://www.kek-
40 online.de/medienkonzentration/mediendatenbank/#/](https://www.kek-online.de/medienkonzentration/mediendatenbank/#/)). Thus, press agencies play a pivotal
41 agenda-setting role in a journalism environment where the pressure for exclusivity may
42 override concerns of accuracy (Johnston & Forde 2009). The rewriting of press releases, i.e.
43 "churnalism", is increasingly common in online news organizations (Johnston & Forde 2009),
44 and the norm in journalism practices has shifted from information interrogation to information
45 dissemination (Lewis et al. 2008). As journalism is no longer exclusively defined by eyewitness
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3 reporting, conservation scientists should contribute knowledge and skills in both aspects of
4 analysis and contextualizing, for example in trans-disciplinary workshops involving conservation
5 scientists, journalists and policy-makers (Hathaway et al. 2017) to maintain standards of
6 accuracy in carnivore-related news.
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10 11 12 *Towards improved communication* 13

14 Higher and more focused engagement of conservation scientists with the media could
15 lead to improved communication on human-carnivore coexistence and governance. As conflicts
16 between humans and wildlife are increasing worldwide with negative impacts on wildlife
17 species and ecosystems (Woodroffe et al. 2005), there is indeed a growing need for integrative
18 approaches to transform human-wildlife conflicts into sustainable coexistence (König et al.
19 2020). We therefore suggest that conservation scientists can participate at multiple steps of the
20 publication process to make sure that accurate information is broadcasted to the public and
21 that human-carnivore coexistence is not jeopardized by news selection, framing and accuracy
22 (Fig. 6). Local and national press agencies are privileged points of contact in this regard.
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30 Conservation scientists can help provide context on an incident (e.g. attack location,
31 history of verified attacks, appropriate behavior) and share expertise on negative (e.g.
32 depredation events, problematic individuals) as well as positive events (e.g. conservation
33 success, tourism opportunities, positive public attitudes) (O'Bryan et al. 2018). Providing follow-
34 up coverage until the end of an official investigation should enable the public to know about
35 the official conclusions of a case. Finally, engaging with journalists would offer different
36 viewpoints on an issue (e.g. that of wildlife biologists, social and political scientists, etc.) and
37 avoid one-sided information (de Vreese & Boomgaarden 2006). On the other hand, journalists
38 should use caution in the attribution of responsibility in case of alleged carnivore attacks and
39 critically evaluate political stances on the topic of carnivore conservation and management.
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49 The ongoing Covid-19 pandemic has had profound impacts on human-nature relations
50 (Soga et al. 2021), while revealing a widespread intensification of fake news and rumors in the
51 media (Hartley & Vu 2020). This calls for increased scrutiny of the media landscape, to ensure
52 that human-nature relations are not artificially distorted by misleading information. Therefore,
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our final recommendation for policy-makers is to establish a platform for fact-checking wildlife news. Fact-checking has become an important component of the media landscape (Graves & Cherubini 2016), and such initiative would help the public to critically evaluate online news concerning human-wildlife coexistence. Ideally, a fact-checking platform would be maintained by a partnership between news organizations and experts in wildlife conservation, with news outlets publishing timely checks of questionable reports.

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FIGURES

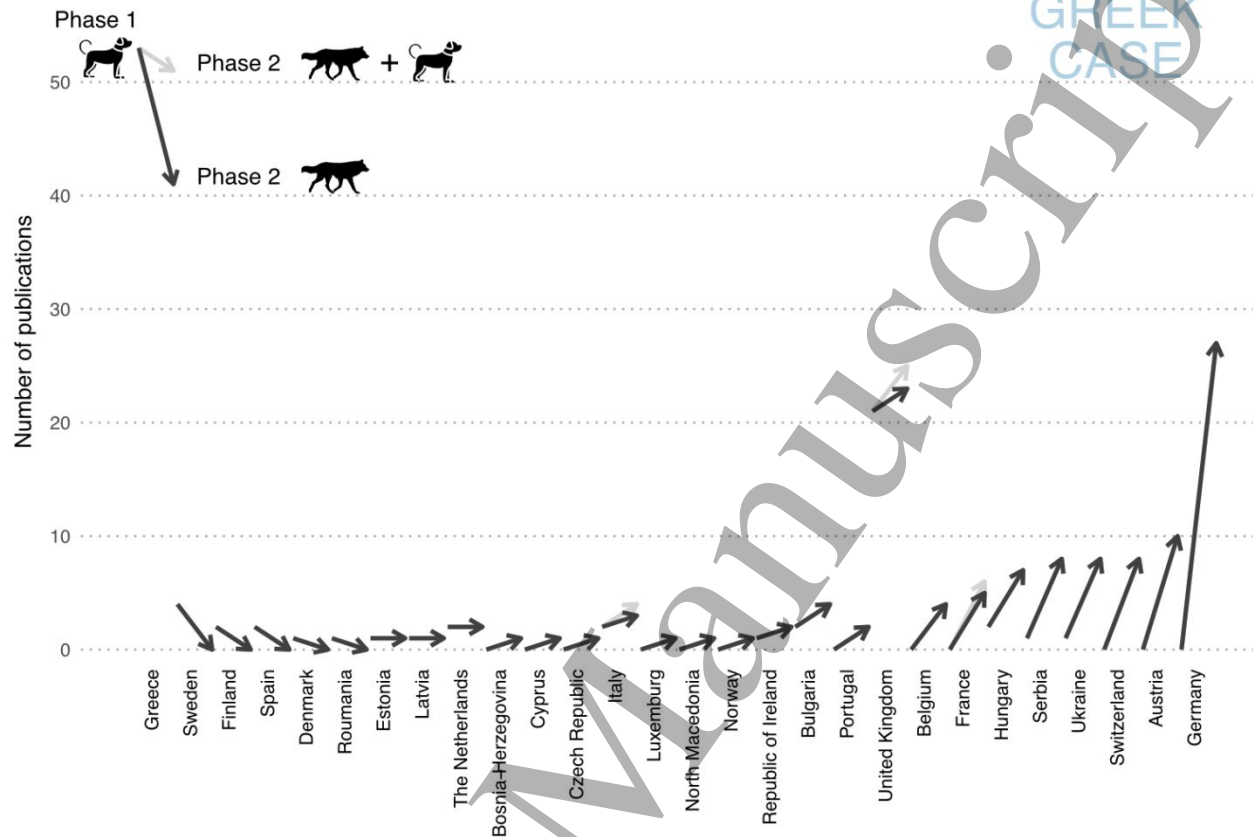


Figure 1. News selection in the Greek case, as indicated by the rate of change in the number of online publications in Europe covering this case (i.e. a British tourist presumably attacked by dogs or wolves in Greece) between two publication phases. For each country, the black arrow start displays the number of publications reporting on the case during Phase 1 (from 22nd to 25th of September 2017) and the black arrow end displays the number of publications mentioning wolves as (at least) “possibly responsible” for the attack (Phase 2, from 26th to 29th of September 2019). The grey arrow displays the total number of publications in Phase 2 (i.e. adding also publications not mentioning wolves).

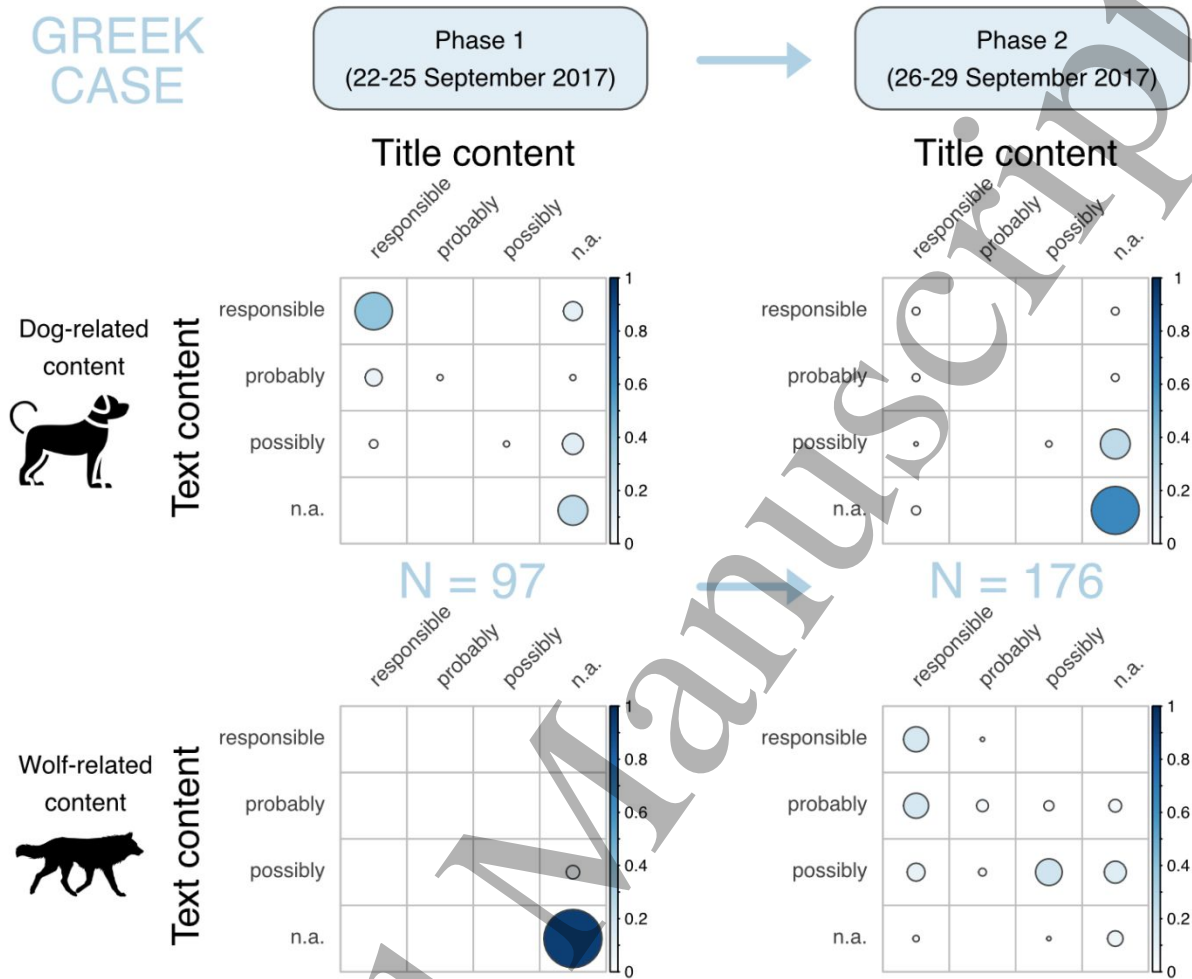


Figure 2. Framing and accuracy of online articles featuring dogs and wolves in the Greek case. The figure shows the comparison of publications' title and text content in relation to a potential attack of dogs (top panels) or wolves (bottom panels) of a British tourist in Greece during two phases of media reporting – before (left panels) and after (right panels) a coronary's interview in The Times where he said the person "may have been attacked by wolves". Circle sizes represent the proportion of publications in each category. "n.a." = species not mentioned in the text and/or title.

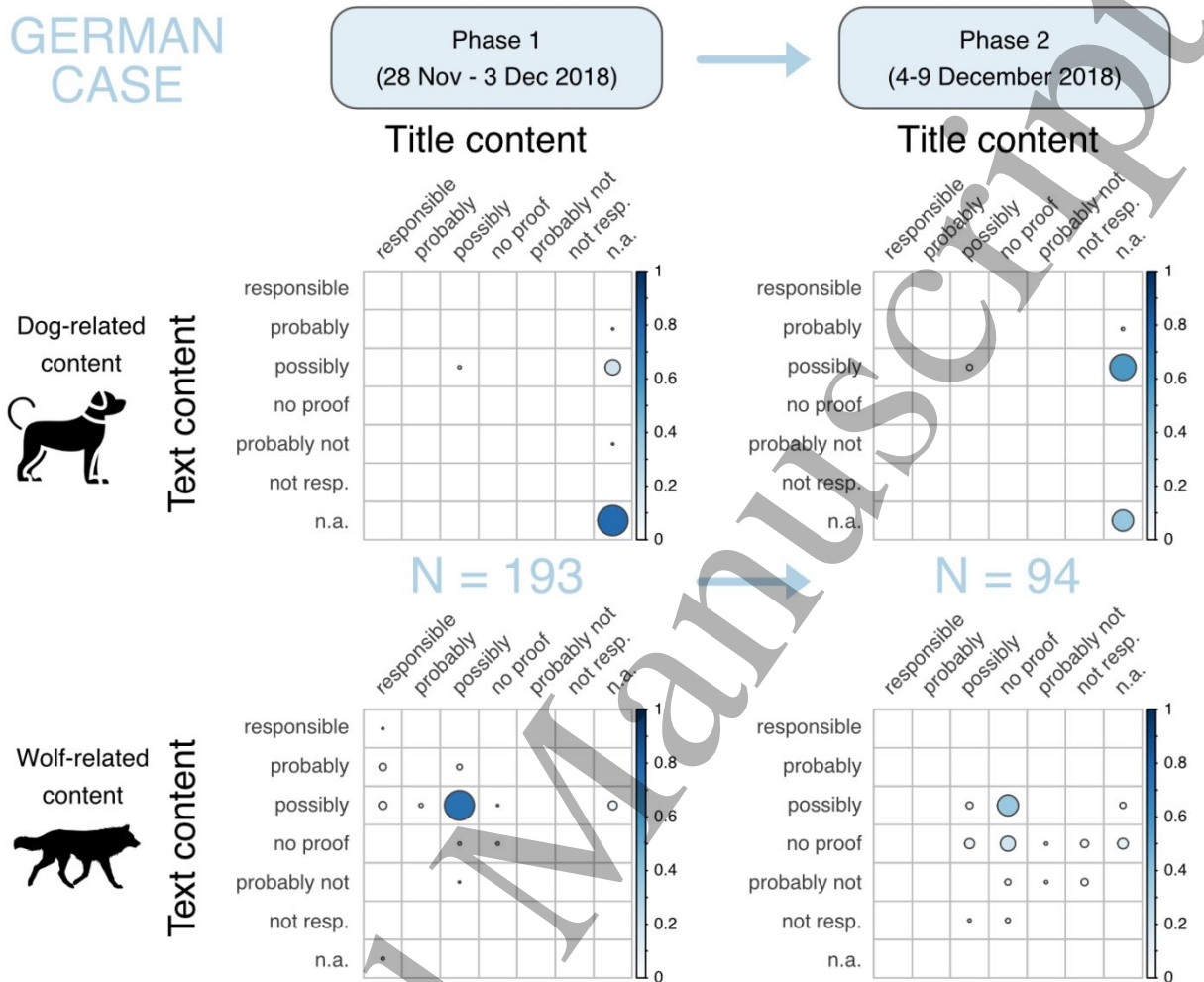


Figure 3. Framing and accuracy of online articles featuring dogs and wolves in the German case. The figure shows the comparison of publications' title and text content in relation to a potential attack of dogs (top panels) or wolves (bottom panels) of a person in Germany during two phases of media reporting – before (left panels) and after (right panels) the public announcement of a DNA investigation showing no DNA traces for wolves, but traces of dogs (plus roe deer and cat). Circle sizes represent the proportion of publications falling in each category. “n.a.” = species not mentioned in the text and/or title.

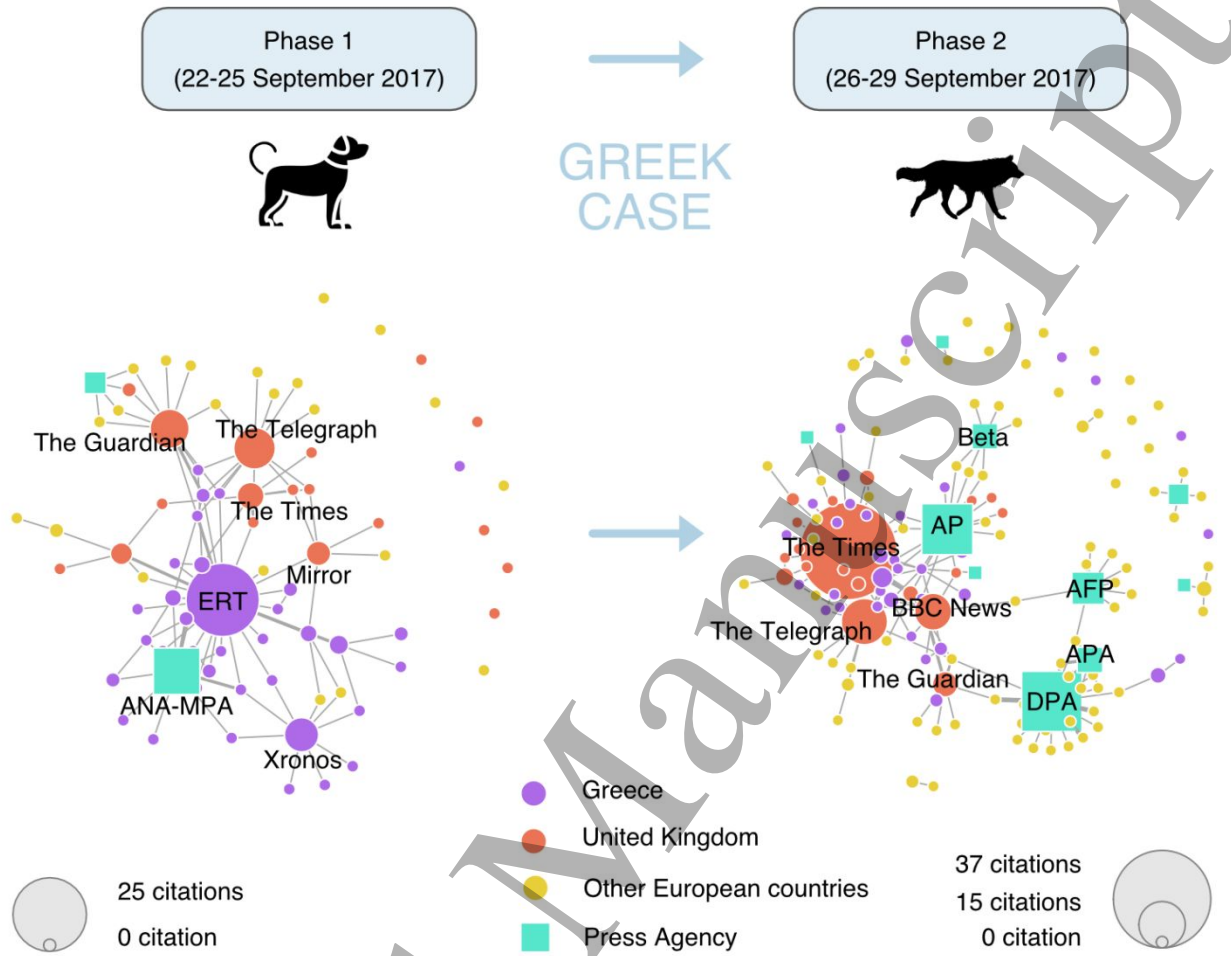


Figure 4. Information flow of the Greek case (i.e. a British tourist presumably attacked by dogs or wolves in Greece) during phase 1 (left, dominated by dog-related reports) and phase 2 (right, dominated by wolf-dominated reports). Network nodes represent news organizations that have released at least one publication online during a specific phase. Network edges (i.e. grey links between nodes) represent a citation of one news organization by another. Node size represents the number of times a specific news organization was cited during a specific phase. In phase 1, publications mostly relied on the releases of the Greek press agency (ANA-MPA) and national broadcaster (ERT), and British newspapers. In phase 2, publications became international and mostly related to British news organizations and national or international press agencies (squares, DPA, APA, Beta, AP) that relayed the information of a potential wolf attack on a person. News organizations that were cited at least five times are displayed in each phase. AFP = French Press Agency; ANA-MPA = Athens News Agency - Macedonian Press Agency; AP = Associated Press; APA = Austrian Press Agency; Beta = Serbian News Agency; DPA = German Press Agency; ERT = Hellenic Broadcasting Corporation.

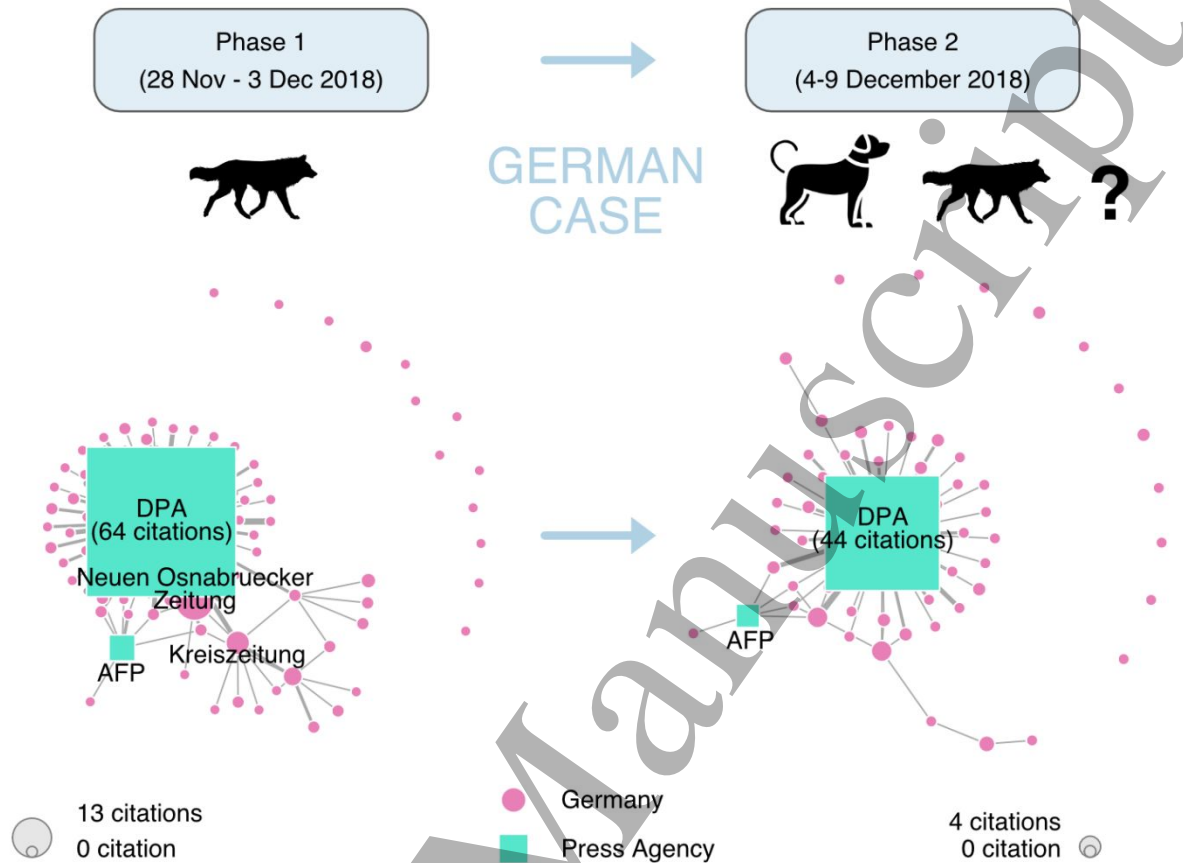


Figure 5. Information flow of the German case (i.e. a community worker presumably attacked by dogs or wolves in Germany) during phase 1 (left, dominated by wolf-related reports) and phase 2 (right, featuring the absence of wolf DNA after investigation). Network nodes represent news organizations that have released at least one publication online during a specific phase. Network edges (i.e. grey links between nodes) represent a citation of one news organization by another. Node size represents the number of times a specific news organization was cited during a specific phase. AFP = French Press Agency; DPA = German Press Agency.

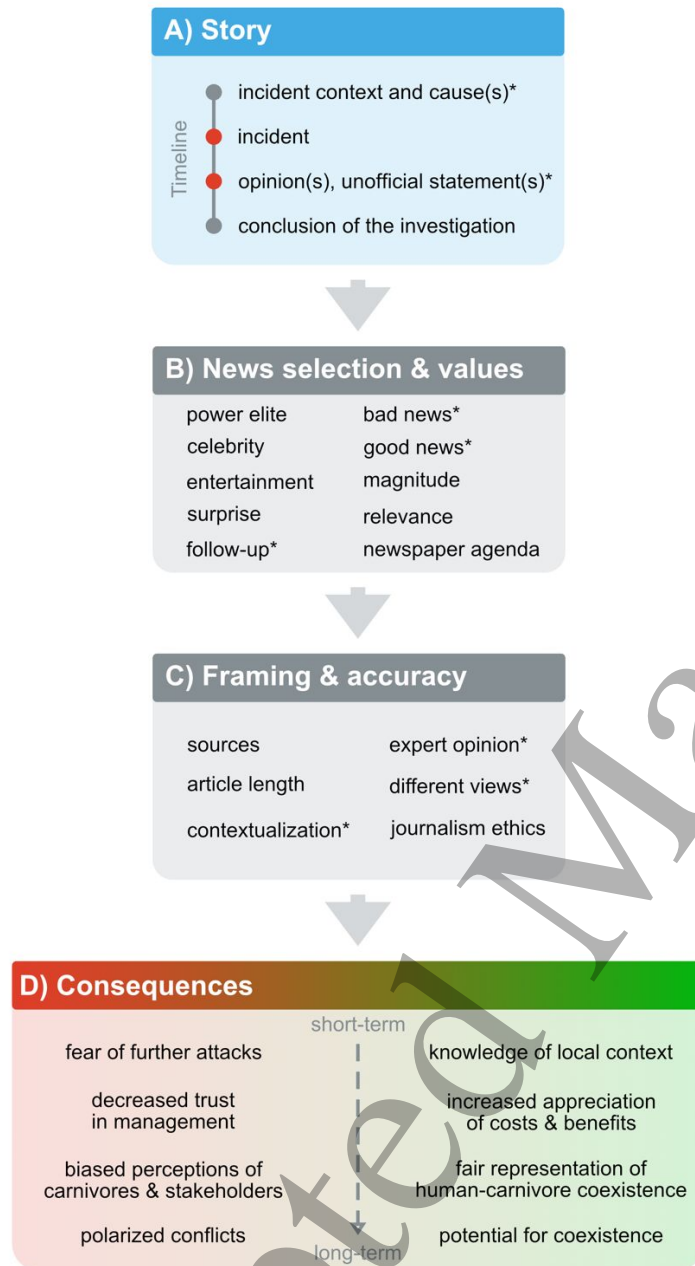


Figure 6. The different steps in the process of news selection, story framing, and the consequences on human-wolf coexistence. When a specific story (box A) matches news selection criteria and specific news values (box B), the way it is framed (box C) can influence local, regional, national and even international state of coexistence between carnivores and men (box D), with potential implications on the short-, medium- and long-term. The scientific community can act in multiple steps of this process (marked with an asterisk*), to help with the analysis and contextualizing of news involving carnivores (and go beyond reporting only incidents and opinions, marked with red dots) and to contribute to a fair representation of costs and benefits of human-wolf coexistence.